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Proposed Amendment to Best Demonstrated Available Technology (BDAT)
Background Document for Wastes from the Production of 1, 1
1-Trichloroethane K028, K029, K095, and K096. Volume 5

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This background document provides the Agency's rationale and technical support for selecting the constituents for proposed regulation in K028 nonwastewaters and K029, K095, and K096 wastewaters and for developing treatment standards for these constituents.

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AMENDMENT TO
BEST DEMONSTRATED AVAILABLE TECHNOLOGY (BDAT)
BACKGROUND DOCUMENT
FOR
FOR WASTES FROM THE PRODUCTION OF
1,1,1-TRICHLOROETHANE
K028, K029, K095, AND K096

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November 1989

Note:

This proposed Background Document is being issued in support of the Agency's proposed rulemaking for the land disposal restrictions program. The Agency solicits comments on the proposed rule and on this proposed Background Document. This document will be issued in final form, appropriately revised in response to comments, at the time of promulgation of the final rule.

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SIMPLIFIED FLOW DIAGRAM FOR PRODUCTION OF
1,1,1-TRICHLOROETHANE.....

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The U.S. Environmental Protection Agency (EPA) is proposing to establish best demonstrated available technology (BDAT) treatment standards for metals in nonwastewater forms of the listed hazardous waste K028 and organics in wastewater forms of the listed wastes K029, K095, and K096. The listed hazardous wastes K028, K029, K095, and K096 were identified in Title 40, Code of Federal Regulations, Section 261.32 (40 CFR 261.32) as wastes from the production of 1,1,1-Trichloroethane. These BDAT treatment standards are being established in accordance with the amendments to the Resource Conservation and Recovery Act (RCRA) of 1976, enacted by the Hazardous and Solid Waste Amendments (HSWA) of November 8, 1984. BDAT treatment standards will be effective no later than May 8, 1990, and on and after the effective date, compliance with these BDAT treatment standards will be a prerequisite under 40 CFR Part 268 for placement of the waste in land disposal units.

When treatment standards are promulgated for K028 nonwastewater metals and K029, K095, and K096 wastewater organics, this background document ("amendment document") will amend the Final Best Demonstrated Available Technology (BDAT) Background Document for Wastes from the Production of 1,1,1-Trichloroethane, K028, K029, K095, and K096 ("the K028 Final Background Document," Reference 1). This background document provides the Agency's rationale and technical support for selecting the constituents for proposed regulation in K028 nonwastewaters and K029, K095, and K096 wastewaters and for developing treatment standards for these constituents.

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The Agency's legal authority and promulgated methodology for establishing treatment standards and the petition process necessary for requesting a variance from the treatment standards are summarized in EPA's Methodology for Developing BDAT Treatment Standards (Reference 2).

This amendment document describes the technologies used to treat K028 nonwastewater metals and K029, K095, and K096 wastewaters (or similar wastes, if any) and presents the treatment performance data on which the treatment standards for these wastes are based. This document also explains how EPA determined BDAT, selected constituents for regulation, and calculated proposed treatment standards for K028 nonwastewater metals and K029, K095, and K096 wastewaters.

The Agency is proposing to regulate three metal constituents in K028 nonwastewaters, five organic constituents in K029 wastewaters, seven organic constituents in K095 wastewaters, and eight organic constituents in K096 wastewaters. No metal constituents are being proposed for regulation in K029, K095, or K096 wastewaters. To determine the applicability of the treatment standards, wastewaters are defined as wastes containing less than 1% (weight basis) total suspended solids¹ (TSS) and less than 1% (weight basis)

¹The term "total suspended solids" (TSS) clarifies EPA's previously used terminology of "total solids" and "filterable solids." Specifically, total suspended solids is measured by Method 209C (total suspended solids dried at 103-105°C) in Standard Methods for the Examination of Water and Wastewater, Sixteenth Edition (Reference 3).

total organic carbon (TOC). Wastes not meeting this definition are classified as nonwastewaters and must comply with the nonwastewater treatment standards.

The Agency does not have any performance data for treatment of K028, K029, K095, and K096. Treatment performance tests for these wastes have not been pursued because the Agency believes that adequate treatment performance data are available from similar wastes that have been previously tested by the BDAT program. Therefore, treatment performance data were transferred from these other previously tested wastes to develop treatment standards for K028 nonwastewater metals and K029, K095, and K096 wastewaters.

For K028 nonwastewaters, proposed BDAT treatment standards for metal constituents are based on treatment performance data transferred from stabilization of F024 incineration ash. Table 1-1 following this section lists the specific proposed BDAT treatment standards for K028 nonwastewater metals. Proposed treatment standards for metal constituents to be regulated in K028 nonwastewaters are based on Toxicity Characteristic Leaching Procedure (TCLP) extracts after stabilization using a cement binder.

The units used for TCLP leachate concentration of metal constituents in K028 nonwastewaters is mg/l (parts per million on a weight-by-volume basis). If the concentrations of the constituents to be regulated in K028 TCLP extracts are lower than or equal to the proposed treatment standards, then treatment of the waste would not be required prior to placement in land disposal units.

For K029, K095, and K096 wastewaters, proposed BDAT treatment standards for organic constituents are based on treatment performance data transferred from the scrubber water residual from incineration of K019. Table 1-2 following this section lists the specific proposed BDAT treatment standards for K029, K095, and K096 wastewaters. Proposed treatment standards for organic constituents to be regulated in K029, K095, and K096 wastewaters are based on the total concentration of each constituent in the waste.

The units used for total constituent concentration of organic constituents in K029, K095, and K096 wastewaters are mg/l (parts per million on a weight-by-volume basis). If the concentrations of the constituents to be regulated in K029, K095, and K096 wastewaters, as generated, are lower than or equal to the proposed treatment standards, then treatment of the waste would not be required prior to placement in land disposal units.

TABLE 1-1
PROPOSED BDAT TREATMENT STANDARDS FOR K028
NONWASTEWATER METALS

Maximum for Any Single Grap Sample	
<u>BDAT List Constituent</u>	<u>Total Concentration</u> <u>(mg/l)</u>
159. Chromium (total)	0.073
161. Lead	0.021
162. Nickel	0.088

TABLE 1-2
PROPOSED BDAT TREATMENT STANDARDS FOR
WASTEWATERS

K029

Maximum for Any Single Grab Sample

<u>BDAT List Constituent</u>	<u>Total Concentration (mg/l)</u>
14. Chloroform	
23. 1,2-Dichloroethane	0.007
24. 1,1-Dichloroethylene	0.007
45. 1,1,1-Trichloroethane	0.033
50. Vinyl Chloride	0.007
	0.033

K095

Maximum for Any Single Grab Sample

<u>BDAT List Constituent</u>	<u>Total Concentration (mg/l)</u>
40. 1,1,1,2-Tetrachloroethane	
41. 1,1,2,2-Tetrachloroethane	0.007
42. Tetrachloroethene	0.007
46. 1,1,2-Trichloroethane	0.007
47. Trichloroethene	0.007
113. Hexachloroethane	0.007
137. Pentachloroethane	0.033
	0.007

K096

Maximum for Any Single Grab Sample

<u>BDAT List Constituent</u>	<u>Total Concentration (mg/l)</u>
40. 1,1,1,2-Tetrachloroethane	
41. 1,1,2,2-Tetrachloroethane	0.007
42. Tetrachloroethene	0.007
46. 1,1,2-Trichloroethane	0.007
47. Trichloroethene	0.007
86. 1,3-Dichlorobenzene	0.007
137. Pentachloroethane	0.008
150. 1,2,4-Trichlorobenzene	0.007
	0.023

Wastes identified as K028, K029, K095, and K096 are defined in 40 CFR 261.32 as follows:

<u>Waste Code</u>	<u>Listed Waste</u>
K028	Spent catalyst from from the hydrochlorinator reactor in the production of 1,1,1-trichloroethane
K029	Waste from the product steam stripper in the production of 1,1,1-trichloroethane
K095	Distillation bottoms from the production of 1,1,1-trichloroethane
K096	Heavy ends from the heavy ends column from the production of 1,1,1-trichloroethane

K028, K029, K095, and K096 are generated during the production and purification of 1,1,1-trichloroethane. 1,1,1-trichloroethane is produced commercially by the catalytic hydrochlorination of vinyl chloride. A simplified flow diagram illustrating the 1,1,1-trichloroethane manufacturing process and the generation of K028, K029, K095, and K096 is presented in Figure 2-1. Vinyl chloride and hydrogen chloride are reacted in the presence of a ferric chloride catalyst to produce a 1,1-dichloroethane intermediate. Spent catalyst is separated from the product stream via filtratin or distillation. The spend catalyst stream is then the listed waste K028. Heavy ends from the heavy ends column, if used, comprise K096. The heavy ends column is generally placed before the secondary chlorinatin reactor to remove heavy ends prior to chlorinatin of the product stream. Light ends may also be removed via distillation and recycled to the hydrochlorinated reactor. The

1,1-dichloroethane intermediate is then reacted with chlorine to produce 1,1,1-trichloroethane. Although not currently generated, K029 may be generated as a steam stripper waste in processes where a steam stripper is used. Distillation bottoms from the final purification of 1,1,1-trichloroethane product comprise K095.

K028 generally consists of greater than 50% chlorinated organic constituents, with the balance of the waste consisting of heavy tars and ferric chloride catalyst. K029, K095, and K096 are expected to contain 100% chlorinated organic constituents. Full characterization data for K028, K029, K095, and K096 is presented in the K028 Final Background Document, Section 2.0.

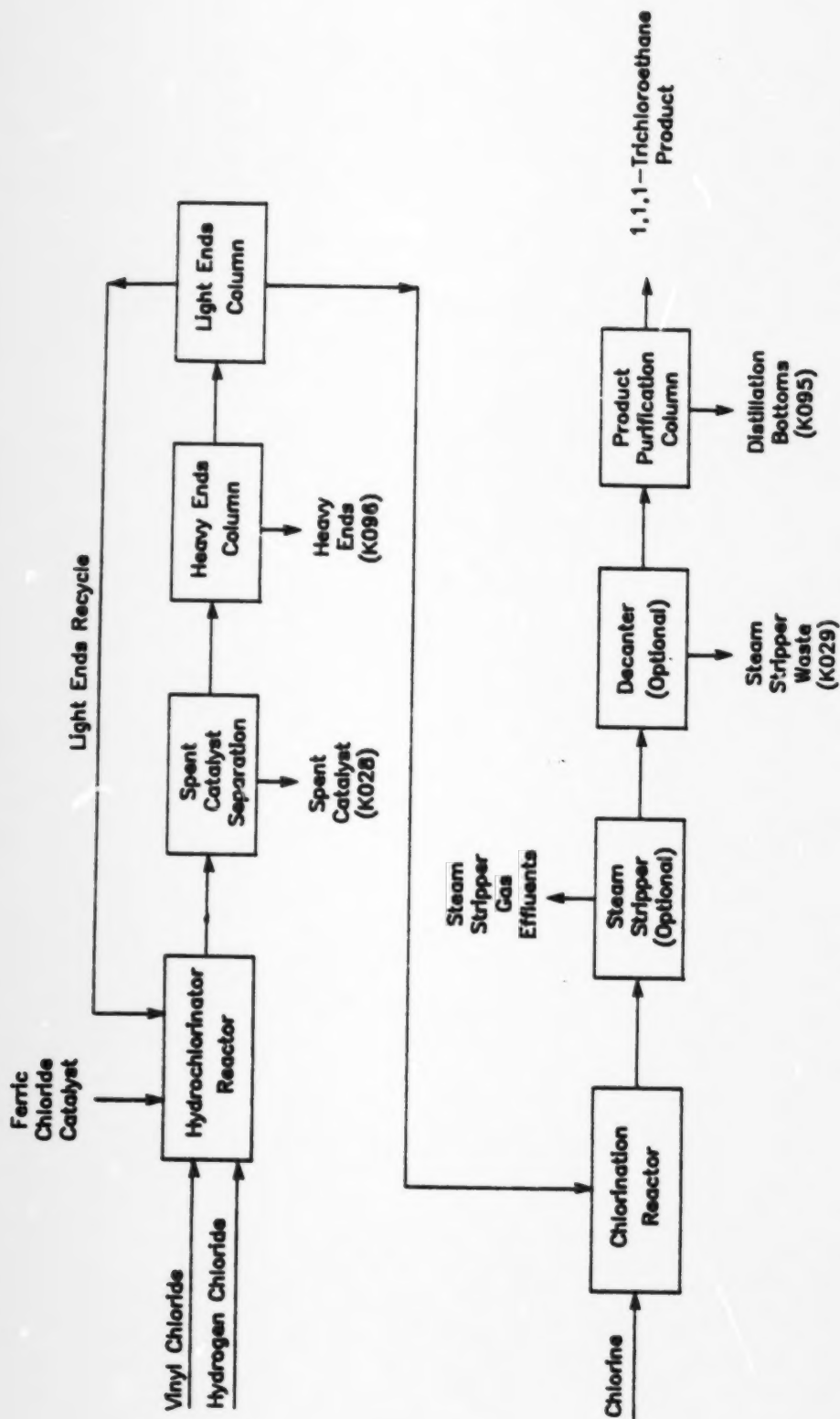


Figure 2-1. Simplified Flow Diagram for Production of 1,1,1-Trichloroethane

3.0

APPLICABLE AND DEMONSTRATED TREATMENT TECHNOLOGIES

This section identifies the treatment technologies that are applicable to K028 nonwastewater metals and K029, K095, and K096 wastewater organics and determines which, if any, of the applicable technologies can be considered demonstrated for the purpose of establishing BDAT.

To be applicable, a technology must theoretically be usable to treat the waste in question or to treat a waste that is similar in terms of parameters that affect treatment selection. (Detailed descriptions of technologies that are applicable to listed hazardous wastes are provided in EPA's Treatment Technology Background Document (Reference 4)). To be demonstrated, a technology must be employed in full-scale operation for treatment of the waste in question or a similar waste. Technologies available only at pilot- or bench-scale operations are not considered in identifying demonstrated technologies.

3.1

Applicable Treatment Technologies for K028 Nonwastewater Metals

Applicable treatment technologies for K028 nonwastewaters were identified in the K028 Final Background Document (Section 3.1.1). The applicable technology for treatment of metals in nonwastewaters is stabilization of the nonwastewater or nonwastewater residual.

3.2

Demonstrated Treatment Technologies for K028 Nonwastewater Metals

The Agency is not aware of any facilities that treat metal constituents in nonwastewater forms of K028 (such as ash from incineration) by stabilization or by any other technology. However, stabilization is demonstrated on wastes judged to be similar, such as F024. The Agency does not have treatment performance data for stabilization of nonwastewater forms of K028, however, for the BDAT program, the Agency has tested stabilization of F024 incinerator ash as discussed in Section 4.0.

3.3

Applicable Treatment Technologies for K029, K095 and K096 Wastewaters

The Agency recognizes that K029, K095, and K096 wastewaters may be generated by treatment technologies other than incineration. Since these wastewaters may contain hazardous organic constituents at treatable levels, applicable technologies include those that destroy or reduce the total amounts of various organic compounds in the waste. The Agency has identified the following treatment technologies as potentially applicable for treatment of K029, K095, and K096 wastewaters: incineration, biological treatment, carbon adsorption, solvent extraction, and recycle and reuse. Potentially applicable treatment technologies are not identified for hazardous metal and inorganic constituents because they are not expected nor does characterization data indicate that they are present in K029, K095, and K096 wastewaters.

3.4

Demonstrated Treatment Technologies for K029, K095 and K096 Wastewaters

The Agency is not aware of any facilities that treat organic constituents in K029, K095, and K096 wastewaters. However, rotary kiln incineration generating a wastewater scrubber water is demonstrated for a similar waste, K019.

The Agency does not have any treatment performance data for treatment of K028 nonwastewater metals or K029, K095, and K096 wastewaters. Therefore, treatment performance data were transferred from other previously tested wastes:

- F024, to develop treatment standards for K028 nonwastewater metals; and
- K019, to develop treatment standards for K029, K095, and K096 wastewaters.

The basis for data transfer and the sources of treatment performance data are discussed in the sections below. The tables are presented at the end of this section.

EPA's methodology for the transfer of treatment performance data is provided in EPA's Methodology for Developing BDAT Treatment Standards (Reference 2). Transfer of treatment performance data is technically valid in cases where the untested wastes are generated from similar industries or similar processing steps as the untested wastes, or the untested wastes have similar waste characteristics affecting treatment performance and treatment selection as the tested wastes. The source of performance data for transfer to K028 nonwastewater metals is F024 incinerator ash, which was stabilized using a cement binder, a lime/fly ash binder, and a kiln ash binder. The source of treatment performance data for transfer to K029, K095, and K096 wastewaters is K019, which was previously treatment tested by rotary kiln incineration and generated a scrubber wastewater residual. (Rotary kiln

incineration and stabilization were identified as applicable and demonstrated for K028, K029, K095, and K096 nonwastewaters in Section 3.0 of the K028 Final Background Document.)

4.1 Treatment of Inorganic Constituents

Stabilization. As discussed in Section 4.2 of the K028 Final Background Document, EPA has data for stabilization of metals in nonwastewaters in the California List Notice of Data Availability (52 Federal Register 29992, August 12, 1987) (Reference 5), for stabilization of F006 and K062 at Plant J, for stabilization at Plant C of incinerator ash generated from fluidized bed incineration of K048 and K051 at Plant B, and for stabilization at Plant C of incinerator ash generated from rotary kiln incineration of F024 at Plant I. (Plant codes are identified in Appendix A of the K028 Final Background Document.) EPA examined these wastes to identify the best data source(s), if any, for transfer of treatment performance data to K028 nonwastewater metals. Specifically, EPA examined whether K028 is (1) generated from similar industries or processing steps and (2) whether K028 has similar waste characteristics affecting treatment performance as the previously tested wastes.

Of the nonwastewaters previously tested by stabilization, F024, like K028, is generated from the chlorinated organic chemicals industry. Similar to K028, F024 is also generated by filtration, or some other type of separation process from the product stream. F024 like K028 is generated from the production of chlorinated organic chemicals having a carbon content

consisting of one to five carbons. In addition, F024 contains metal constituents similar to those characteristic in K028.

Waste characterization data for K028 indicate that the metal constituents present in K028 and K028 TCLP extracts are barium (2.13 ppm), chromium (total) (1.33 ppm), copper (4.21 ppm), lead (1.17 ppm), nickel (4.63 ppm), vanadium (0.353 ppm), and zinc (5.43 ppm) in the mg/l (or ppm) range. TCLP extract results for untreated F024 incinerator ash indicate that untreated F024 contains barium (1.67-1.99 ppm), chromium (total) (0.4-0.42 ppm), copper (5.54-9.59 ppm), lead (14.9-63.3 ppm), nickel (3.95-4.39 ppm), and zinc (2.06-2.07 ppm) also in the mg/l (or ppm) range. Based on these similarities in metal constituents and constituent concentrations, the Agency has determined that metal constituents in K028 nonwastewaters will closely resemble in type and level those present in untreated F024 incinerator ash.

Therefore, since F024 is generated from a similar industry and processing steps as K028, and since the two wastes are expected to contain similar metals, treatment standards for metals in K028 nonwastewaters were developed from treatment performance data transferred from stabilization of F024 incinerator ash.

As discussed in the F024 Background Document Addendum (Reference 6) and the F024 Stabilization Onsite Engineering Report (Reference 7), treatment performance data were collected for the stabilization of F024 incinerator ash using a cement binder, a lime/fly ash binder, and a kiln dust binder. The cement binder was judged best for F024 using analysis

of variance (ANOVA) tests as described in the F024 Background Document Addendum (Reference 6).

The treatment performance data for the stabilization of F024 incinerator ash using a cement binder are presented in Table 4-1.

4.2 Treatment of Organic Constituents

Incineration. Wastes previously tested by the Agency by rotary kiln or fluidized-bed incineration include: K001, K019, K024, K037, K086, K087, K101, K102, F024, K048, and K051. EPA examined these wastes to identify the best data source(s), if any, for transfer of treatment performance data to K029, K095, and K096 wastewaters. Specifically, EPA examined whether the untested wastes are (1) generated from similar industries or processing steps and (2) whether the wastes have similar waste characteristics affecting treatment performance as these previously tested wastes.

Of the wastes previously tested by incineration, two wastes, F024 and K019, are generated from the chlorinated organic chemicals industry. Similar to K029, K095, and K096, F024 and K019 are also generated by distillation, filtration, or some other type of separation process from the product stream. K019, like K029, K095, and K096, is generated from the production of chlorinated ethanes and contains high concentrations of these constituents. F024 is generated from the production of chlorinated organic chemicals having a carbon content of one to five. Although F024 includes wastes from the production of chlorinated ethanes, the F024 feed streams

treatment tested by the Agency did not contain chlorinated ethanes at concentrations as high as those detected in the K019 that was treatment tested by the Agency.

As discussed in the Treatment Technology Background Document (Reference 4), waste characteristics that affect treatment performance for rotary kiln and fluidized-bed incineration include the thermal conductivity of the waste and the boiling points and bond dissociation energies of the constituents of concern. (Boiling points and bond dissociation energies of the constituents of concern for each waste are provided in Appendix B.) K029, K095, and K096, which predominately contain organic constituents, are expected to have thermal conductivities similar to F024 and K019. In addition, the BDAT List constituents in K029, K095, and K096 are, in general, more volatile (i.e., have lower boiling points) and have lower bond dissociation energies than BDAT List constituents in F024 and K019. Therefore, based on thermal conductivity, boiling points, and bond dissociation energies, K029, K095, and K096 are easier to treat than either F024 or K019.

Waste characterization data indicate that 1,1,1-trichloroethane is the major organic constituent in K029 and is present at high concentrations of up to approximately 83 percent. 1,1,1-Trichloroethane, however, was not found in the F024 wastes that were tested during the BDAT demonstrations. In the K019 wastes, that were tested, this constituent was present at concentrations up to 81,000 mg/kg. Due to the fact that 1,1,1-trichloroethane was present in significant concentrations in K019 but not detected in F024, the Agency has determined that K029 more closely resembles K019 rather than F024. This is

further supported by the similarities in concentrations of 1,2-dichloroethane (i.e., 170,000 mg/kg in K029 and up to 130,000 mg/kg in K019, versus 2,700 mg/kg in F024.)

Characterization data also indicate that K095 and K096 wastes contain up to 580,000 mg/kg and 720,000 mg/kg, respectively, of 1,1,2-trichloroethane. The F024 wastes that were tested had up to 891 mg/kg (maximum) of this constituent. While K019 had no detectable concentrations of this constituent, it did contain up to 81,000 mg/kg of 1,1,1-trichloroethane, which is an isomer of the 1,1,2-trichloroethane. Due to the similarities in structure of these two isomers and the significantly higher concentrations of the 1,1,1-trichloroethane in K019, the Agency has determined that K095 and K096 more clearly resemble K019 wastes rather than F024.

Based on the similarities discussed above, treatment standards for organic constituents in K029, K095, and K096 wastewaters were developed from treatment performance data transferred from rotary kiln incineration of K019 at Plant A.

K019 and three other wastes, referred to as "RCRA Blend," "PCB Blend," and "mercaptan-contaminated waste," were treated at Plant A (see the K028 Final Background Document, Reference 1). K019 and RCRA Blend were fed to the rotary kiln; PCB Blend and mercaptan-contaminated waste were fed to the afterburner (secondary combustor). Therefore, scrubber water generated from the afterburner of the rotary kiln represents treatment of all the wastes fed to the incinerator. Tables 4-2 through 4-7 present the BDAT List organic

constituents detected in the untreated wastes (K019, RCRA Blend, PCB Blend, and mercaptan-contaminated waste) collected by EPA from the rotary kiln incineration treatment system at Plant A and the analysis results of BDAT List organic constituents in the scrubber water residual at Plant A. Design and operating data for the rotary kiln and the secondary combustor at Plant A are presented in Table 4-4, Section 4.0 of the K028 Final Background Document.

Table 4-1

TCLP ANALYTICAL RESULTS FOR THE STABILIZED F024 INCINERATOR ASH SAMPLES - CEMENT BINDER

Binder-to-Ash Ratio: 0.55
Water-to-Ash Ratio: 0.2

BDAT List Constituent	Detection Limit (mg/l)	Concentration in Untreated Waste (mg/l)			Concentration in the 28-Day Cure Treated Waste (mg/l)		
		1	2	3	1	2	3
154. Antimony	0.076	ND	ND	ND	ND	ND	ND
155. Arsenic	0.002	0.013	0.015	0.014	0.004	0.002	0.002
156. Barium	0.002	1.99	1.72	1.67	1.84	0.88	1.02
157. Beryllium	0.001	0.002	0.002	0.002	ND	ND	ND
158. Cadmium	0.003	0.021	0.021	0.021	ND	ND	ND
159. Chromium (total)	0.007	0.4	0.41	0.42	0.031	0.01	0.013
221. Chromium (VI)	0.006	0.34	0.075	0.049	0.19	0.15	0.14
160. Copper	0.018	5.54	6.71	9.59	ND	ND	ND
161. Lead	0.057	63.3	33.3	14.9	0.011	0.006	0.007
162. Mercury	0.0003	0.0006	ND	ND	ND	ND	ND
163. Nickel	0.025	4.39	3.96	3.93	ND	ND	ND
164. Selenium	0.002	ND	ND	ND	ND	ND	ND
165. Silver	0.004	ND	ND	ND	ND	ND	ND
166. Thallium	0.004	ND	ND	ND	ND	ND	ND
167. Vanadium	0.007	ND	ND	ND	ND	ND	ND
168. Zinc	0.003	2.06	2.07	2.06	0.041	0.05	0.173
* Aluminum	0.023	15.8	16.9	16.4	0.45	0.28	0.26
* Calcium	0.001	584	584	588	2003	1870	1880
* Cobalt	0.01	0.06	0.053	0.049	ND	0.012	ND
* Iron	0.012	13.1	12.8	13.2	0.022	0.037	0.17
* Magnesium	0.001	146	140	145	0.095	0.30	1.28
* Manganese	0.001	1.98	2.19	2.21	ND	ND	0.001
* Molybdenum	0.037	ND	0.041	ND	0.062	0.056	0.078
* Sodium	0.021	45	44.8	45.1	37.4	37.2	37.4
* Tin	0.105	1.04	0.43	0.32	ND	ND	ND

ND-Not detected.

Source: Draft Onsite Engineering Report of Treatment Technology Performance and Operation for Waterways Experiment Station, Vicksburg, Mississippi (Reference 2).

Table 4-2

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - COMBUSTION GAS SCRUBBER TREATMENT SYSTEM

SAMPLE SET #1

Detected BDAT List Organic Constituents	Concentration in Untreated Waste			Concentration in Treated Waste	
	K019 mg/kg (ppm)	RCRA Blend* mg/kg (ppm)	PCB Blend* mg/kg (ppm)	Mercaptan- Contaminated Waste* mg/L (ppm)	Scrubber Water mg/L (ppm)
<u>VOLATILES</u>					
4. Benzene	<2,000	2,000	<2,000	17.0	<0.002
7. Carbon tetrachloride	4,000	<8	<2,000	1.90	<0.002
9. Chlorobenzene	3,000	<8	<2,000	<0.4	<0.002
14. Chloroform	4,600	<8	<2,000	<0.4	<0.002
21. Dichlorodifluoromethane	<200	<8	<2,000	<0.4	<0.002
22. 1,1-Dichloroethane	2,200	<8	<2,000	<0.4	<0.002
23. 1,2-Dichloroethane	93,000	<8	<2,000	<0.4	<0.002
34. Methyl ethyl ketone	<1,000	940	<2,000	<0.4	<0.002
38. Methylene chloride	<1,000	910	<10,000	3.5	<0.01
42. Tetrachloroethene	7,300	490	<10,000	<2.0	<0.01
43. Toluene	<200	2,300	<2,000	<0.4	<0.002
45. 1,1,1-Trichloroethane	81,000	130	41,000	3.7	<0.002
47. Trichloroethene	3,210	360	<2,000	2.3	<0.002
215-217. Xylene (total)	<200	3,400	3,600	<0.4	<0.002
222. Acetone	<1,000	1,200	36,000	4.4	<0.002
226. Ethyl benzene	<200	2,200	<10,000	<2.0	<0.01
229. Methyl isobutyl ketone	<1,000	1,100	16,000	4.1	<0.002
			<10,000	<2.0	<0.01
<u>SEMIVOLATILES</u>					
51. Acenaphthalene	<10	150	120	<0.002	<0.002
52. Acenaphthene	<10	<20	480	<0.002	<0.002
56. Aniline	<25	<50	<250	1.22	<0.005
57. Anthracene	<10	110	400	<0.002	<0.002
65. Benzo(k)fluoranthene	<10	67	<100	<0.002	<0.002
68. Bis(2-chloroethyl)ether	280	<20	<100	<0.002	<0.002
70. Bis(2-ethylhexyl)phthalate	<10	40	<100	0.079	<0.002

* Only one sample of this waste type was taken. The results are repeated in each sample set.

Table 4-2 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - COMBUSTION GAS SCRUBBER TREATMENT SYSTEM

SAMPLE SET #1 (Continued)

Detected BDAT List Organic Constituents	Concentration in Untreated Waste				Concentration in Treated Waste
	K019 mg/kg (ppm)	RCRA Blend* mg/kg (ppm)	PCB Blend* mg/kg (ppm)	Mercaptan- Contaminated Waste* mg/L (ppm)	Scrubber Water mg/L (ppm)
<u>SEMIVOLATILES (Continued)</u>					
80. Chrysene	SNA	28	<100	<0.002	<0.002
81. ortho-Cresol	<10	<20	<100	0.020	<0.002
87. o-Dichlorobenzene	<10	250	1,060	2.55	<0.002
88. p-Dichlorobenzene	81	32	460	0.260	<0.002
90. 2,4-Dichlorophenol	<25	<50	<250	0.420	<0.005
91. 2,6-Dichlorophenol	<25	<50	500	0.430	<0.005
98. Di-n-butyl phthalate	<10	31	120	0.012	<0.002
104. Di-n-octyl phthalate	<10	<20	430	<0.002	<0.002
108. Fluoranthene	<10	120	300	<0.002	<0.002
109. Fluorene	20	53	340	<0.002	<0.002
110. Hexachlorobenzene	69	<100	<500	0.022	<0.010
111. Hexachlorobutadiene	<50	210	<500	0.079	<0.010
113. Hexachloroethane	120	<100	<500	0.018	<0.010
121. Naphthalene	470	<20	400	0.133	<0.002
122. 1,4-Naphthoquinone	<10	<20	<100	0.078	<0.002
126. Nitrobenzene	<25	3,400	8,200	0.027	<0.005
136. Pentachlorobenzene	61	<100	1,000	0.020	<0.010
141. Phenanthrene	21	240	950	<0.002	<0.002
142. Phenol	<10	78	1,000	4.56	<0.002
145. Pyrene	<10	200	260	<0.002	<0.002
148. 1,2,4,5-Tetrachlorobenzene	76	<50	1,400	0.008	<0.005
150. 1,2,4-Trichlorobenzene	100	<50	19,000	1.24	<0.005
152. 2,4,6-Trichlorophenol	<50	<100	<500	0.037	<0.010

SNA A standard is not available; the compound was searched using an NBS Library data-base of 42,000 compounds. The compound was not detected.

* Only one sample of this waste type was taken. The results are repeated in each sample set.

Table 4-3

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - COMBUSTION GAS SCRUBBER TREATMENT SYSTEM

Detected BDAT List Organic Constituents	Concentration in Untreated Waste				Concentration in Treated Waste	
	K019 mg/kg (ppm)	RCRA Blend* mg/kg (ppm)	PCB Blend* mg/kg (ppm)	Mercaptan- Contaminated Waste* mg/L (ppm)	Scrubber Water	
					mg/L (ppm)	
<u>VOLATILES</u>						
4. Benzene	<2,000	2,000	<2,000	17.0	<0.002	<0.002
7. Carbon tetrachloride	3,800	<8	<2,000	1.90	<0.002	<0.002
9. Chlorobenzene	<2,000	<8	<2,000	<0.4	<0.002	<0.002
14. Chloroform	5,800	<8	<2,000	<0.4	<0.002	<0.002
21. Dichlorodifluoromethane	<2,000	<8	<2,000	<0.4	<0.002	<0.002
22. 1,1-Dichloroethane	<2,000	<8	<2,000	<0.4	<0.002	<0.002
23. 1,2-Dichloroethane	96,000	<8	<2,000	<0.4	<0.002	<0.002
34. Methyl ethyl ketone	<10,000	940	<10,000	3.5	<0.010	<0.010
38. Methylene chloride	<10,000	910	<10,000	<2.0	<0.010	<0.010
42. Tetrachloroethene	6,700	490	<2,000	<0.4	<0.002	<0.002
43. Toluene	<2,000	2,300	41,000	3.7	0.0032	0.0032
45. 1,1,1-Trichloroethane	33,000	130	<2,000	2.3	<0.002	<0.002
47. Trichloroethene	2,400	360	3,600	<0.4	<0.002	<0.002
215-217. Xylene (total)	<2,000	3,400	36,000	4.4	<0.002	<0.002
222. Acetone	<10,000	1,200	<10,000	<2.0	<0.01	<0.01
226. Ethyl benzene	<2,000	2,200	16,000	4.1	<0.002	<0.002
229. Methyl isobutyl ketone	<10,000	1,100	<10,000	<2.0	<0.01	<0.01
<u>SEMIVOLATILES</u>						
51. Acenaphthalene	<10	150	120	<0.002	<0.002	<0.002
52. Acenaphthene	<10	<20	480	<0.002	<0.002	<0.002
56. Aniline	<25	<50	<250	1.22	<0.005	<0.005
57. Anthracene	<10	110	400	<0.002	<0.002	<0.002
65. Benzo(k)fluoranthene	<10	67	<100	<0.002	<0.002	<0.002
68. Bis(2-chloroethyl) ether	280	<20	<100	<0.002	<0.002	<0.002
70. Bis(2-ethylhexyl) phthalate	<10	40	<100	0.079	<0.002	<0.002

* Only one sample of this waste type was taken. The results are repeated in each sample set.

Table 4-3 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - COMBUSTION GAS SCRUBBER TREATMENT SYSTEM

SAMPLE SET #2 (Continued)

Detected BDAT List Organic Constituents	Concentration in Untreated Waste			Concentration in Treated Waste	
	K019 mg/kg (ppm)	RCRA Blend* mg/kg (ppm)	PCB Blend* mg/kg (ppm)	Mercaptan- Contaminated Waste* mg/L (ppm)	Scrubber Water mg/L (ppm)
<u>SEMIVOLATILES (Continued)</u>					
80. Chrysene	SNA	28	<100	<0.002	<0.002
81. ortho-Cresol	<10	<20	<100	0.020	<0.002
87. o-Dichlorobenzene	74	250	1,060	2.55	<0.002
88. p-Dichlorobenzene	<25	32	460	0.260	<0.002
90. 2,4-Dichlorophenol	<25	<50	<250	0.420	<0.005
91. 2,6-Dichlorophenol	<10	<50	500	0.430	<0.005
98. Di-n-butyl phthalate	<10	31	120	0.012	0.0063
104. Di-n-octyl phthalate	<10	<20	430	<0.002	<0.002
108. Fluoranthene	<10	120	300	<0.002	<0.002
109. Fluorene	16	53	340	<0.002	<0.010
110. Hexachlorobenzene	60	<100	<500	0.022	<0.010
111. Hexachlorobutadiene	<50	210	<500	0.079	<0.010
113. Hexachloroethane	85	<100	<500	0.018	<0.010
121. Naphthalene	314	<20	400	0.133	<0.002
122. 1,4-Naphthoquinone	<10	<20	<100	0.078	<0.002
126. Nitrobenzene	<25	3,400	8,200	0.027	<0.002
136. Pentachlorobenzene	51	<100	1,000	0.020	<0.005
141. Phenanthrene	15	240	950	<0.002	<0.010
142. Phenol	<10	78	1,000	4.56	<0.002
145. Pyrene	<10	200	260	<0.002	<0.002
148. 1,2,4,5-Tetrachlorobenzene	62	<50	1,400	0.008	<0.002
150. 1,2,4-Trichlorobenzene	65	<50	19,000	1.24	<0.005
152. 2,4,6-Trichlorophenol	<50	<100	<500	0.037	<0.010

SNA A standard is not available; the compound was searched using an NBS Library data-base of 42,000 compounds. The compound was not detected.

* Only one sample of this waste type was taken. The results are repeated in each sample set.

Table 4-4

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - COMBUSTION GAS SCRUBBER TREATMENT SYSTEM

SAMPLE SET #3

Detected BDAT List Organic Constituents	Concentration in Untreated Waste			Concentration in Treated Waste	
	K019 mg/kg (ppm)	RCRA Blend* mg/kg (ppm)	PCB Blend* mg/kg (ppm)	Mercaptan- Contaminated Waste* mg/L (ppm)	Scrubber Water mg/L (ppm)
VOLATILES					
4. Benzene	<2,000	2,000	<2,000	17.0	<0.002
7. Carbon tetrachloride	3,500	<8	<2,000	1.90	<0.002
9. Chlorobenzene	<2,000	<8	<2,000	<0.4	<0.002
14. Chloroform	5,000	<8	<2,000	<0.4	<0.002
21. Dichlorodifluoromethane	<2,000	<8	<2,000	<0.4	0.0043
22. 1,1-Dichloroethane	<2,000	<8	<2,000	<0.4	<0.002
23. 1,2-Dichloroethane	87,000	<8	<2,000	<0.4	<0.002
34. Methyl ethyl ketone	<10,000	940	<2,000	3.5	<0.01
38. Methylene chloride	<10,000	910	<10,000	<2.0	<0.01
42. Tetrachloroethene	6,000	490	<2,000	<0.4	<0.002
43. Toluene	<2,000	2,300	41,000	3.7	0.0026
45. 1,1,1-Trichloroethane	34,000	130	<2,000	2.3	<0.002
47. Trichloroethene	2,200	360	3,600	<0.4	<0.002
215-217. Xylene (total)	<2,000	3,400	36,000	4.4	<0.002
222. Acetone	<10,000	1,200	<10,000	<2.0	<0.01
226. Ethyl benzene	<2,000	2,200	16,000	4.1	<0.002
229. Methyl isobutyl ketone	<10,000	1,100	<10,000	<2.0	<0.01
SEMI-VOLATILES					
51. Acenaphthalene	<10	150	120	<0.002	<0.002
52. Acenaphthene	<10	<20	480	<0.002	<0.002
56. Aniline	<25	<50	<250	1.22	<0.005
57. Anthracene	<10	110	400	<0.002	<0.002
65. Benzo(k)fluoranthene	<10	67	<100	<0.002	<0.002
68. Bis(2-chloroethyl)ether	290	<20	<100	<0.002	<0.002
70. Bis(2-ethylhexyl)phthalate	<10	40	<100	0.079	<0.002

* Only one sample of this waste type was taken. The results are repeated in each sample set.

Table 4-4 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - COMBUSTION GAS SCRUBBER TREATMENT SYSTEM

SAMPLE SET #3 (Continued)

Detected BDAT List Organic Constituents	Concentration in Untreated Waste				Concentration in Treated Waste
	K019 mg/kg (ppm)	RCRA Blend* mg/kg (ppm)	PCB Blend* mg/kg (ppm)	Mercaptan- Contaminated Waste* mg/L (ppm)	Scrubber Water mg/L (ppm)
<u>SEMIVOLATILES (Continued)</u>					
80. Chrysene	SNA	28	<100	<0.002	<0.002
81. ortho-Cresol	<10	<20	<100	0.020	<0.002
87. o-Dichlorobenzene	<10	250	1,060	2.55	<0.002
88. p-Dichlorobenzene	80	32	460	0.260	<0.002
90. 2,4-Dichlorophenol	<25	<50	<250	0.420	<0.005
91. 2,6-Dichlorophenol	<25	<50	500	0.430	<0.005
98. Di-n-butyl phthalate	<10	31	120	0.012	0.0046
104. Di-n-octyl phthalate	<10	<20	430	<0.002	<0.002
108. Fluoranthene	<10	120	300	<0.002	<0.002
109. Fluorene	19	53	340	<0.002	<0.01
110. Hexachlorobenzene	73	<100	<500	0.022	<0.01
111. Hexachlorobutadiene	<50	210	<500	0.079	<0.01
113. Hexachloroethane	95	<100	<500	0.018	<0.002
121. Naphthalene	350	<20	400	0.133	<0.002
122. 1,4-Naphthoquinone	<10	<20	<100	0.078	<0.002
126. Nitrobenzene	<25	3,400	8,200	0.027	<0.005
136. Pentachlorobenzene	59	<100	1,000	0.020	<0.010
141. Phenanthrene	11	240	950	<0.002	<0.002
142. Phenol	<10	78	1,000	4.56	<0.002
145. Pyrene	<10	200	260	<0.002	<0.002
148. 1,2,4,5-Tetrachlorobenzene	67	<50	1,400	0.008	<0.005
150. 1,2,4-Trichlorobenzene	70	<50	19,000	1.240	<0.005
152. 2,4,6-Trichlorophenol	<50	<100	<500	0.037	<0.010

SNA A standard is not available; the compound was searched using an NBS Library data-base of 42,000 compounds. The compound was not detected.

* Only one sample of this waste type was taken. The results are repeated in each sample set.

Table 4-5

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - COMBUSTION GAS SCRUBBER TREATMENT SYSTEM

SAMPLE SET #4

Detected BDAT List Organic Constituents	Concentration in Untreated Waste			Concentration in Treated Waste	
	K019 mg/kg (ppm)	RCRA Blend* mg/kg (ppm)	PCB Blend* mg/kg (ppm)	Mercaptan- Contaminated Waste* mg/L (ppm)	Scrubber Water mg/L (ppm)
VOLATILES					
4. Benzene	<2,000	2,000	<2,000	17.0	<0.002
7. Carbon tetrachloride	3,900	<8	<2,000	1.90	<0.002
9. Chlorobenzene	<2,000	<8	<2,000	<0.4	<0.002
14. Chloroform	5,300	<8	<2,000	<0.4	<0.002
21. Dichlorodifluoromethane	<2,000	<8	<2,000	<0.4	0.014
22. 1,1-Dichloroethane	<2,000	<8	<2,000	<0.4	<0.002
23. 1,2-Dichloroethane	122,000	<8	<2,000	<0.4	<0.002
34. Methyl ethyl ketone	<10,000	940	<10,000	3.5	<0.01
38. Methylene chloride	<10,000	910	<10,000	<2.0	<0.01
42. Tetrachloroethene	7,200	490	<2,000	<0.4	<0.002
43. Toluene	<2,000	2,300	41,000	3.7	0.0046
45. 1,1,1-Trichloroethane	44,000	130	<2,000	2.3	<0.002
47. Trichloroethene	2,300	360	3,600	<0.4	<0.002
215-217. Xylene (total)	<2,000	3,400	36,000	4.4	<0.002
222. Acetone	<10,000	1,200	<10,000	<2.0	<0.01
226. Ethyl benzene	<2,000	2,200	16,000	4.1	<0.002
229. Methyl isobutyl ketone	<10,000	1,100	<10,000	<2.0	<0.01
SEMIVOLATILES					
51. Acenaphthalene	<10	150	120	<0.002	<0.002
52. Acenaphthene	<10	<20	480	<0.002	<0.002
56. Aniline	<25	<50	<250	1.22	<0.005
57. Anthracene	<10	110	400	<0.002	<0.002
65. Benzo(k)fluoranthene	<10	67	<100	<0.002	<0.002
68. Bis(2-chloroethyl)ether	310	<20	<100	<0.002	<0.002
70. Bis(2-ethylhexyl)phthalate	<10	40	<100	0.079	<0.002

* Only one sample of this waste type was taken. The results are repeated in each sample set.

Table 4-5 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - COMBUSTION GAS SCRUBBER TREATMENT SYSTEM

SAMPLE SET #4 (Continued)

Detected BDAT List Organic Constituents	Concentration in Untreated Waste				Concentration in Treated Waste	
	K019 mg/kg (ppm)	RCRA Blend* mg/kg (ppm)	PCB Blend* mg/kg (ppm)	Mercaptan- Contaminated Waste* mg/L (ppm)	Scrubber Water mg/L (ppm)	
<u>SEMIVOLATILES (Continued)</u>						
80. Chrysene	SNA	28	<100	<0.002		<0.002
81. ortho-Cresol	<10	<20	<100	0.020		<0.002
87. o-Dichlorobenzene	<10	250	1,060	2.55		<0.002
88. p-Dichlorobenzene	84	32	460	0.260		<0.002
90. 2,4-Dichlorophenol	<25	<50	<250	0.420		<0.002
91. 2,6-Dichlorophenol	<25	<50	500	0.430		<0.005
98. Di-n-butyl phthalate	<10	31	120	0.012		<0.005
104. Di-n-octyl phthalate	<10	<20	430	<0.002		0.0042
108. Fluoranthene	<10	120	300	<0.002		<0.002
109. Fluorene	21	53	340	<0.002		<0.002
110. Hexachlorobenzene	61	<100	<500	0.022		<0.010
111. Hexachlorobutadiene	<50	210	<500	0.079		<0.010
113. Hexachloroethane	94	<100	<500	0.018		<0.010
121. Naphthalene	360	<20	400	0.133		<0.002
122. 1,4-Naphthoquinone	<10	<20	<100	0.078		<0.002
126. Nitrobenzene	<25	3,400	8,200	0.027		<0.002
136. Pentachlorobenzene	64	<100	1,000	0.020		<0.005
141. Phenanthrene	19	240	950	<0.002		<0.010
142. Phenol	<10	78	1,000	4.56		<0.002
145. Pyrene	<10	200	260	<0.002		<0.002
148. 1,2,4,5-Tetrachlorobenzene	82	<50	1,400	0.008		<0.002
150. 1,2,4-Trichlorobenzene	74	<50	19,000	1.240		<0.005
152. 2,4,6-Trichlorophenol	<50	<100	<500	0.037		<0.005
						<0.010

SNA A standard is not available; the compound was searched using an NBS Library data-base of 42,000 compounds. The compound was not detected.

* Only one sample of this waste type was taken. The results are repeated in each sample set.

Table 4-6

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - COMBUSTION GAS SCRUBBER TREATMENT SYSTEM

SAMPLE SET #5

Detected BDAT List Organic Constituents	Concentration in Untreated Waste			Concentration in Treated Waste
	K019 mg/kg (ppm)	RCRA Blend* mg/kg (ppm)	PCB Blend* mg/kg (ppm)	Mercaptan- Contaminated Waste* mg/L (ppm)
VOLATILES				
4. Benzene	<2,000	2,000	<2,000	17.0
7. Carbon tetrachloride	4,000	<8	<2,000	1.90
9. Chlorobenzene	<2,000	<8	<2,000	<0.4
14. Chloroform	6,000	<8	<2,000	<0.4
21. Dichlorodifluoromethane	<2,000	<8	<2,000	<0.4
22. 1,1-Dichloroethane	<2,000	<8	<2,000	<0.4
23. 1,2-Dichloroethane	130,000	<8	<2,000	<0.4
34. Methyl ethyl ketone	<10,000	940	<10,000	3.5
38. Methylene chloride	<10,000	910	<10,000	<2.0
42. Tetrachloroethene	7,800	490	<2,000	<0.4
43. Toluene	<2,000	2,300	41,000	<0.002
45. 1,1,1-Trichloroethane	45,000	130	<2,000	<0.002
47. Trichloroethene	2,500	360	3,600	<0.002
215-217. Xylene (total)	<2,000	3,400	36,000	<0.002
222. Acetone	<10,000	1,200	<10,000	<0.01
226. Ethyl benzene	<2,000	2,200	16,000	<0.002
229. Methyl isobutyl ketone	<10,000	1,100	<10,000	<0.01
SEMI-VOLATILES				
51. Acenaphthalene	<10	150	120	<0.002
52. Acenaphthene	<10	<20	480	<0.002
56. Aniline	<25	<50	<250	<0.005
57. Anthracene	<10	110	400	<0.002
65. Benzo(k)fluoranthene	<10	67	<100	<0.002
68. Bis(2-chloroethyl)ether	340	<20	<100	<0.002
70. Bis(2-ethylhexyl)phthalate	<10	40	<100	<0.002

* Only one sample of this waste type was taken. The results are repeated in each sample set.

Table 4-6 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - COMBUSTION GAS SCRUBBER TREATMENT SYSTEM

SAMPLE SET #5 (Continued)

Detected BDAT List Organic Constituents	Concentration in Untreated Waste				Concentration in Treated Waste
	K019 mg/kg (ppm)	RCRA Blend* mg/kg (ppm)	PCB Blend* mg/kg (ppm)	Mercaptan- Contaminated Waste* mg/L (ppm)	Scrubber Water mg/L (ppm)
<u>SEMIVOLATILES (Continued)</u>					
80. Chrysene	SNA	28	<100	<0.002	<0.002
81. ortho-Cresol	<10	<20	<100	0.020	<0.002
87. o-Dichlorobenzene	<10	250	1,060	2.55	<0.002
88. p-Dichlorobenzene	90	32	460	0.260	<0.002
90. 2,4-Dichlorophenol	<25	<50	<250	0.420	<0.005
91. 2,6-Dichlorophenol	<25	<50	500	0.430	<0.005
98. Di-n-butyl phthalate	<10	31	120	0.012	0.0027
104. Di-n-octyl phthalate	<10	<20	430	<0.002	<0.002
108. Fluoranthene	<10	120	300	<0.002	<0.002
109. Fluorene	19	53	340	<0.002	<0.002
110. Hexachlorobenzene	87	<100	<500	0.022	<0.01
111. Hexachlorobutadiene	<50	210	<500	0.079	<0.01
113. Hexachloroethane	113	<100	<500	0.018	<0.01
121. Naphthalene	371	<20	400	0.133	<0.002
122. 1,4-Naphthoquinone	<10	<20	<100	0.078	<0.002
126. Nitrobenzene	<25	3,400	8,200	0.027	<0.005
136. Pentachlorobenzene	63	<100	1,000	0.020	<0.01
141. Phenanthrene	19	240	950	<0.002	<0.002
142. Phenol	<10	78	1,000	4.56	<0.002
145. Pyrene	<10	200	260	<0.002	<0.002
148. 1,2,4,5-Tetrachlorobenzene	73	<50	1,400	0.008	<0.005
150. 1,2,4-Trichlorobenzene	72	<50	19,000	1.240	<0.005
152. 2,4,6-Trichlorophenol	<50	<100	<500	0.037	<0.010

SNA A standard is not available; the compound was searched using an NBS Library data-base of 42,000 compounds. The compound was not detected.

* Only one sample of this waste type was taken. The results are repeated in each sample set.

Table 4-7

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - COMBUSTION GAS SCRUBBER TREATMENT SYSTEM

Detected BDAT List Organic Constituents	Concentration in Untreated Waste				Concentration in Treated Waste	
	K019 mg/kg (ppm)	RCRA Blend* mg/kg (ppm)	PCB Blend* mg/kg (ppm)	Mercaptan- Contaminated Waste* mg/L (ppm)	Scrubber	
					Water	
VOLATILES						
4. Benzene	<2,000	2,000	<2,000	17.0	<0.002	
7. Carbon tetrachloride	4,100	<8	<2,000	1.90	<0.002	
9. Chlorobenzene	<2,000	<8	<2,000	<0.4	<0.002	
14. Chloroform	5,600	<8	<2,000	<0.4	<0.002	
21. Dichlorodifluoromethane	<2,000	<8	<2,000	<0.4	<0.002	
22. 1,1-Dichloroethane	<2,000	<8	<2,000	<0.4	<0.002	
23. 1,2-Dichloroethane	98,000	<8	<2,000	<0.4	<0.002	
34. Methyl ethyl ketone	<10,000	940	<10,000	3.5	<0.01	
38. Methylene chloride	<10,000	910	<10,000	<2.0	<0.01	
42. Tetrachloroethene	6,900	490	<2,000	<0.4	<0.002	
43. Toluene	<2,000	2,300	41,000	3.7	<0.002	
45. 1,1,1-Trichloroethane	44,000	130	<2,000	2.3	<0.002	
47. Trichloroethene	2,500	360	3,600	<0.4	<0.002	
215-217. Xylene (total)	<2,000	3,400	36,000	4.4	<0.002	
222. Acetone	<10,000	1,200	<10,000	<2.0	<0.01	
226. Ethyl benzene	<2,000	2,200	16,000	4.1	<0.002	
229. Methyl isobutyl ketone	<10,000	1,100	<10,000	<2.0	<0.01	
SEMIVOLATILES						
51. Acenaphthalene	<10	150	120	<0.002	<0.002	
52. Acenaphthene	<10	<20	480	<0.002	<0.002	
56. Aniline	<25	<50	<250	1.22	<0.005	
57. Anthracene	<10	110	400	<0.002	<0.002	
65. Benzo(k)fluoranthene	<10	67	<100	<0.002	<0.002	
68. Bis(2-chloroethyl) ether	330	<20	<100	<0.002	<0.002	
70. Bis(2-ethylhexyl)phthalate	<10	40	<100	0.079	<0.002	

* Only one sample of this waste type was taken. The results are repeated in each sample set.

Table 4-7 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - COMBUSTION GAS SCRUBBER TREATMENT SYSTEM

SAMPLE SET #6 (Continued)

Detected BDAT List Organic Constituents	Concentration in Untreated Waste				Concentration in Treated Waste
	K019 mg/kg (ppm)	RCRA Blend* mg/kg (ppm)	PCB Blend* mg/kg (ppm)	Mercaptan- Contaminated Waste* mg/L (ppm)	Scrubber Water mg/L (ppm)
<u>SEMIVOLATILES (Continued)</u>					
80. Chrysene	SNA	28	<100	<0.002	<0.002
81. ortho-Cresol	<10	<20	<100	0.020	<0.002
87. o-Dichlorobenzene	<10	250	1,060	2.55	<0.002
88. p-Dichlorobenzene	90	32	460	0.260	<0.002
90. 2,4-Dichlorophenol	<25	<50	<250	0.420	<0.005
91. 2,6-Dichlorophenol	<25	<50	500	0.430	<0.005
98. Di-n-butyl phthalate	<10	31	120	0.012	0.0025
104. Di-n-octyl phthalate	<10	<20	430	<0.002	<0.002
108. Fluoranthene	<10	120	300	<0.002	<0.002
109. Fluorene	22	53	340	<0.002	<0.002
110. Hexachlorobenzene	66	<100	<500	0.022	<0.01
111. Hexachlorobutadiene	<50	210	<500	0.079	<0.01
113. Hexachloroethane	88	<100	<500	0.018	<0.01
121. Naphthalene	390	<20	400	0.133	<0.002
122. 1,4-Naphthoquinone	<10	<20	<100	0.078	<0.002
126. Nitrobenzene	<25	3,400	8,200	0.027	<0.005
136. Pentachlorobenzene	65	<100	1,000	0.020	<0.01
141. Phenanthrene	17	240	950	<0.002	<0.002
142. Phenol	<10	78	1,000	4.56	<0.002
145. Pyrene	<10	200	260	<0.002	<0.002
148. 1,2,4,5-Tetrachlorobenzene	86	<50	1,400	0.008	<0.005
150. 1,2,4-Trichlorobenzene	79	<50	19,000	1.24	<0.005
152. 2,4,6-Trichlorophenol	<50	<100	<500	0.037	<0.01

SNA A standard is not available; the compound was searched using an NBS Library data-base of 42,000 compounds. The compound was not detected.

* Only one sample of this waste type was taken. The results are repeated in each sample set.

5.0

IDENTIFICATION OF PROPOSED BEST DEMONSTRATED AND AVAILABLE TECHNOLOGY (BDAT) FOR K028 NONWASTEWATER METALS AND K029, K095, AND K096 WASTEWATERS

This section presents the Agency's rationale for determining the proposed best demonstrated available technology (BDAT) for K028 nonwastewater metals and K029, K095, and K096 wastewater organics. BDAT for K028 nonwastewater metals has been determined to be stabilization using a cement binder. BDAT for K029, K095, and K096 wastewaters has been determined to be rotary kiln incineration.

As discussed in Section 3.0 of this amendment, the Agency has identified stabilization as a demonstrated technology for metals in K028 nonwastewaters and incineration as a demonstrated technology for treatment of organic constituents in K028, K029, K095, and K096 wastewaters. In the absence of treatment performance data for K028, K029, K095, and K096, treatment performance data from similar wastes were transferred to these wastes, as discussed in Section 4.0 of this amendment.

For a treatment technology to be identified as BDAT, the treatment performance data are first screened to determine whether they represent operation of a well-designed and well-operated treatment system, whether sufficient analytical quality assurance/quality control measures were employed to ensure the accuracy of the data, whether the appropriate measures of performance were used to assess the performance of the particular treatment technology, and whether the technology is considered "available."

The treatment performance data and the design and operating data collected during the test of stabilization of F024 incinerator ash at Plant I and of rotary kiln incineration of K019 at plant A were reviewed against the criteria described above. The appropriate measures of performance (TCLP extract concentration for stabilization and total constituent concentration for incineration) were used to assess the treatment systems. Additionally, the Agency had no reason to believe that the treatment systems at plant I and at plant A were not well-designed and well-operated, or that insufficient analytical quality assurance/quality control measures were employed in generating treatment performance data.

An "available" treatment technology is one that (1) is not a proprietary or patented process that cannot be purchased or licensed from the proprietor (i.e., it must be commercially available), and (2) substantially diminishes the toxicity of the waste or substantially reduces the likelihood of migration of hazardous constituents from the waste. The demonstrated technology for treatment of K028 nonwastewater metals--stabilization--is considered to be commercially available and the data presented in Section 4.0 show substantial treatment of constituents of concern. Therefore, stabilization is an available technology for treatment of metal constituents in K028 nonwastewaters. The demonstrated technology for treatment of K029, K095, and K096 wastewaters--rotary kiln incineration--is also considered to be commercially available and the data presented in Section 4.0 show substantial treatment of constituents of concern. Therefore, incineration is an available technology for treatment of organic constituents in K029, K095, and K096 wastewaters.

In cases where the Agency has treatment performance data for a waste for more than one treatment technology, EPA uses the statistical method known as the analysis of variance (ANOVA) test to determine if one technology performs significantly better than the others. (The ANOVA test is discussed in EPA's Methodology for Developing BDAT Treatment Standards (Reference 2 .) For K028 nonwastewater metals, data were transferred from F024 stabilization tests. ANOVA test results comparing stabilization binders are presented in the F024 Background Document (Reference 6) and stabilization with the cement binder was judged to be the best demonstrated and available technology for K028 nonwastewater metals. For K029, K095, and K096, the Agency has transferred treatment performance data for only one treatment technology (rotary kiln incineration); and an ANOVA comparison is not appropriate. This technology has been determined to represent the best demonstrated available technology for K029, K095, and K096 wastewaters.

The proposed BDAT technologies for K028, K029, K095, and K096 do not preclude a facility from recycling or reuse operations according to the conditions specified in 40 CFR Part 261.2. In addition, the proposed BDAT technologies do not preclude the use of other treatment technologies that can achieve the treatment standards.

SELECTION OF CONSTITUENTS PROPOSED FOR REGULATION

This section presents the methodology and rationale for selection of metal constituents being proposed for regulation in K028 nonwastewaters and for organic constituents being proposed for regulation in K029, K095, and K096 wastewaters. Generally, regulated constituents must satisfy the following criteria:

1. They must be on the BDAT EPA List of constituents.
(Presence on the BDAT List means that approved methods exist for analyzing the constituent in treated waste matrices.)
2. They must be present in or be suspected of being present in the untreated waste. For example, analytical difficulties may prevent a constituent from being identified in the untreated waste, but its identification in a treatment residual may lead the Agency to conclude that it is present in the untreated waste.
3. Where treatment performance data are transferred, the regulated constituents must be no more difficult to treat than the constituents from which performance data are transferred. Factors used to assess ease of treatment vary according to the technology of concern. For example, for incineration, the factors include bond dissociation energy and boiling point. This criterion is discussed in Section 7.0.

The Agency initially considered all constituents on the BDAT List for regulation. Table 6-1 in the K028 Final Background Document summarizes available waste characterization data for K028, K029, K095, and K096 for the BDAT List constituents. If an analysis for a constituent was performed but the constituent was not detected in the untreated or treated waste, the table indicates "ND" for that constituent. Constituents for which no analysis was performed are identified by "NA" (not analyzed). Those constituents deleted from consideration and those constituents selected for proposed regulation in

K028 nonwastewaters and K029, K095, and K096 wastewaters are discussed in the sections below.

6.1 K028 Nonwastewater Metals

The Agency initially considered all metal constituents on the BDAT List for proposed regulation in nonwastewater forms of K028. However, a BDAT List metal constituent was deleted from further consideration for regulation if (1) the constituent was not detected in the untreated waste, (2) the constituent was not analyzed for in the untreated waste, or (3) other reasons, as discussed in Section 6.1.1. Constituents that were selected for regulation are discussed in Section 6.1.2.

6.1.1 BDAT List Metal Constituents Deleted from Consideration for Proposed Regulation

A BDAT List metal constituent that was detected in untreated K028 was deleted from consideration for regulation if (1) available treatment performance data for the constituent in F024 (from which data are being transferred) did not show effective treatment by BDAT, or (2) other reasons, as described below. BDAT List metal constituents that remained following the deletions described in this subsection were further considered for regulation. These constituents are total chromium, lead, and nickel.

Barium was deleted from further consideration for proposed regulation in K028 nonwastewaters because the BDAT treatment performance data

obtained from stabilization of F024 incinerator ash (from which data are being transferred) do not show effective treatment for this constituent.

Copper, vanadium, and zinc were considered for proposed regulation in K028 nonwastewaters but were not selected as regulated constituents. Although the metal compounds, copper cyanide, vanadium pentoxide, and zinc cyanide are listed in Appendix VIII of 40 CFR Part 261, the individual metals, copper, vanadium, and zinc, are not listed. In this Third Third rulemaking, the Agency is only proposing regulation of copper, vanadium, and/or zinc in listed hazardous wastes when they cannot be controlled by regulation of other metal constituents. For K028, copper, vanadium, and zinc are believed to be controlled by the regulation of total chromium, lead, and nickel and are therefore not being regulated.

6.1.2 Selection of BDAT List Metal Constituents for Proposed Regulation

Metal constituents selected for proposed regulation in K028 nonwastewaters were selected from the BDAT List metal constituents detected in the untreated waste, unless they were deleted from consideration, as discussed in Section 6.1.1.

The metal constituents to be selected for proposed regulation were determined after consideration of (1) the concentration of the constituent in the untreated waste and (2) whether the constituent is adequately controlled by regulation of another constituent.

Based on this discussion, three metal constituents were selected for proposed regulation in K028 nonwastewaters. These constituents are total chromium, lead, and nickel.

6.2 K029, K095, and K096 Wastewaters

The Agency initially considered all organic constituents on the BDAT List for proposed regulation in wastewater forms of K029, K095, and K096. However, a BDAT List constituent was deleted from consideration for regulation if: (1) the constituent was not detected in the untreated waste and is not suspected of being present in the waste; and (2) the constituent was not analyzed for in the untreated waste as discussed in Section 6.2.1. Constituents that were selected for regulation are discussed in Section 6.2.2.

6.2.1 BDAT List Constituents Deleted from Consideration for Proposed Regulation

BDAT List Constituents That Were Not Detected in the Untreated Waste. BDAT List constituents that were not detected in untreated K029, K095, and K096 (labeled "ND" in Table 6-1 of the K028 Final Background Document) were deleted from consideration for regulation. Since detection limits vary according to the nature of the waste matrix being analyzed, the detection limits, if available, determined in the characterization of K029, K095, and K096, are included in Appendix D of the K028 Final Background Document.

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BDAT List Constituents That Were Not Analyzed for in the Untreated Waste. Some constituents on the BDAT List were deleted from consideration for regulation because these constituents were not analyzed for in untreated K029, K095, and K096, (labeled "NA" in Table 6-1 of the K028 Final Background Document). Constituents such as organochlorine pesticides, phenoxyacetic acid herbicides, organophosphorus insecticides, PCBs, dioxins, and furans were not analyzed for in the untreated wastes because it was extremely unlikely that these constituents would be present in these wastes.

6.2.2 Selection of BDAT List Constituents for Proposed Regulation

All of the organic constituents that were further considered for regulation in K029, K095, and K096 wastewaters have been selected for proposed regulation. The constituents being proposed for regulation are presented in Table 6-1.

Table 6-1
BDAT LIST CONSTITUENTS SELECTED FOR PROPOSED REGULATION
IN WASTEWATERS

K029

- 14. Chloroform
- 23. 1,2-Dichloroethane
- 24. 1,1-Dichloroethylene
- 45. 1,1,1-Trichloroethane
- 50. Vinyl chloride

K095

- 40. 1,1,1,2-Tetrachloroethane
- 41. 1,1,2,2-Tetrachloroethane
- 42. Tetrachloroethene
- 46. 1,1,2-Trichloroethane
- 47. Trichloroethane
- 113. Hexachloroethane
- 137. Pentachloroethane

K096

- 40. 1,1,1,2-Tetrachloroethane
- 41. 1,1,2,2-Tetrachloroethane
- 42. Tetrachloroethene
- 46. 1,1,2-Trichloroethane
- 47. Trichloroethane
- 86. 1,3-Dichlorobenzene
- 137. Pentachloroethane
- 150. 1,2,4-Trichlorobenzene

7.0

CALCULATION OF PROPOSED BDAT TREATMENT STANDARDS FOR K028 NONWASTEWATER METALS AND K029, K095, AND K096 WASTEWATER ORGANICS

The Agency bases numerical treatment standards for regulated constituents on the performance of well-designed and well-operated BDAT treatment systems. These standards must account for analytical limitations in available treatment performance data, and the data must be adjusted for variabilities related to treatment, sampling, and analytical techniques and procedures. Using the available treatment performance data from the BDAT treatment technologies, this section calculates proposed treatment standards for K028 nonwastewater metals and K029, K095, and K096 wastewaters for the constituents selected for regulation. All tables are presented at the end of this section.

7.1

K028 Nonwastewater Metals

Proposed BDAT treatment standards for metal constituents in K028 nonwastewater residuals were calculated based on the transfer of three sample sets of treatment performance data from the stabilization of F024 incinerator ash. Before treatment standards are calculated, the treatment performance data are corrected to account for analytical interferences associated with the chemical matrices of the samples. A complete discussion of the accuracy correction of treatment data is provided in Appendix C of the K028 Final Background Document. Table 7-1 presents the corrected TCLP concentrations of metal constituents in the stabilized F024 rotary kiln incinerator ash. Concentration data are presented for only those constituents used to develop treatment standards for metal constituents in K028 nonwastewaters.

The proposed treatment standards for K028 nonwastewater metals were calculated as shown in Table 7-2. The following three steps were used to calculate the treatment standards:

- (1) The arithmetic average of the accuracy-corrected concentrations for each regulated constituent in the treated waste was calculated using the data presented in Table 7-1 of this document.
- (2) Using the same data, a variability factor (discussed in EPA's Methodology for Developing BDAT Treatment Standards) was calculated that represents the variability inherent in the performance of the treatment system, the collection of treated samples, and the analysis of samples. Where concentrations in the treated waste were reported as less than or equal to the detection limit for all the data points in the data set, variability is still expected, since the actual concentrations could range from zero to the detection limit. In these cases, the Agency assumed a lognormal distribution of data points between the detection limit and a value one-tenth of the detection limit and then calculated a variability factor of 2.8.
- (3) The proposed treatment standard for each constituent to be regulated was calculated by multiplying the arithmetic average of the accuracy-corrected concentrations (step (1) above) by the variability factor (step (2) above).

7.2 K029, K095, and K096 Wastewaters

Proposed BDAT treatment standards for K029, K095, and K096 wastewaters were calculated based on the transfer of six sample sets of scrubber water treatment performance data from the rotary kiln incineration of K019. Before treatment standards are calculated, the treatment performance data are corrected to account for analytical interferences associated with the chemical matrices of the samples. A complete discussion of the accuracy correction of treatment data is provided in Appendix C of the K028 Final Background Document.

Treatment performance data for each constituent to be regulated in K029, K095, and K096 were transferred from data for the same constituent in K019, if that constituent was detected in the untreated K019. For a constituent not detected in the untreated K019, a treatment standard was developed for K029, K095, or K096 based on treatment performance data from another constituent that was detected in the untreated K019. The particular constituent from which data are transferred is determined based on the characteristics of the waste that affect treatment performance of incineration with respect to the wastewater residual (i.e., scrubber water). In the secondary chamber (or afterburner), energy in the form of heat is added to destabilize chemical bonds to initiate the combustion reactions. To determine whether one constituent is equally or more difficult to destabilize than another constituent, the Agency examines the bond dissociation energies of the constituents.

In general, the Agency believes that a constituent with a higher bond dissociation energy (BDE) is more difficult to treat than a constituent with a lower BDE. Therefore, treatment performance data were transferred to K029, K095, and K096 wastewaters from constituents detected in untreated K019 that had an equal or higher BDE. Specific cases where data were transferred from another constituent are summarized below and are noted on Tables 7-3 to 7-5. Bond dissociation energies calculated for K019, K029, K095, and K096 constituents are presented in Appendix A.

24. 1,1-Dichloroethylene (K029). The proposed treatment standard for 1,1-dichloroethylene (BDE 505 kcal/mol) in K029 is based on data transferred from treatment of hexachloroethane (BDE 565 kcal/mol) in K019. Based on the waste characteristics that affect treatment performance of rotary kiln incineration, the Agency expects that 1,1-dichloroethylene can be treated to concentrations as low as or lower than hexachloroethane.

40. 1,1,1,2-Tetrachloroethane (K095 and K096). The proposed treatment standard for 1,1,1,2-tetrachloroethane (BDE 605 kcal/mol) in K095 and K096 is based on data transferred from treatment of 1,1,1-trichloroethane (BDE 625 kcal/mol) in K019. Based on the waste characteristics that affect treatment performance of rotary kiln incineration, the Agency expects that 1,1,1,2-tetrachloroethane can be treated to concentrations as low as or lower than 1,1,1-trichloroethane.

41. 1,1,2,2-Tetrachloroethane (K095 and K096). The proposed treatment standard for 1,1,2,2-tetrachloroethane (BDE 605 kcal/mol) in K095 and K096 is based on data transferred from treatment of 1,1,1-trichloroethane (BDE 625 kcal/mol) in K019. Based on the waste characteristics that affect treatment performance of rotary kiln incineration, the Agency expects that 1,1,2,2-tetrachloroethane can be treated to concentrations as low as or lower than 1,1,1-trichloroethane.

46. 1,1,2-Trichloroethane (K095 and K096). The proposed treatment standard for 1,1,2-trichloroethane (BDE 625 kcal/mol) in K095 and K096 is based on data transferred from treatment of 1,1,1-trichloroethane (BDE

625 kcal/mol) in K019. Based on the waste characteristics that affect treatment performance of rotary kiln incineration, the Agency expects that 1,1,2-trichloroethane can be treated to concentrations as low as or lower than 1,1,1-trichloroethane.

50. Vinyl Chloride (K029). The proposed treatment standard for vinyl chloride (BDE 525 kcal/mol) in K029 is based on data transferred from treatment of hexachloroethane (BDE 565 kcal/mol) in K019. Based on the waste characteristics that affect treatment performance of rotary kiln incineration, the Agency expects that vinyl chloride can be treated to concentrations as low as or lower than hexachloroethane.

86. 1,3-Dichlorobenzene (K096). The proposed treatment standard for 1,3-dichlorobenzene (BDE 1,325 kcal/mol) in K096 is based on data transferred from treatment of p-Dichlorobenzene (BDE 1,325 kcal/mol) in K019. Based on the waste characteristics that affect treatment performance of rotary kiln incineration, the Agency expects that 1,3 dichlorobenzene can be treated to concentrations as low as or lower than p-Dichlorobenzene.

137. Pentachloroethane (K095 and K096). The proposed treatment standard for pentachloroethane (BDE 585 kcal/mol) in K095 and K096 is based on data transferred from treatment of 1,1,1-trichloroethane (BDE 625 kcal/mol) in K019. Based on the waste characteristics that affect treatment performance of rotary kiln incineration, the Agency expects that pentachloroethane can be treated to concentrations as low as or lower than 1,1,1-trichloroethane.

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The proposed treatment standards for K029, K095, and K096 wastewaters were calculated as shown in Tables 7-3, 7-4, and 7-5.

Table 7-1

CORRECTED CONCENTRATION DATA FOR METAL
CONSTITUENTS IN STABILIZED F024 INCINERATOR ASH USED FOR
TRANSFER TO K028 NONWASTEWATERS

<u>BDAT List Constituent</u>	<u>Corrected TCLP Concentration in the Treated Waste (mg/l)</u>		
	<u>Sample Set</u>		
	<u>1</u>	<u>2</u>	<u>3</u>
159. Chromium (total)	0.036	0.011	0.015
161. Lead	0.014	0.008	0.009
163. Nickel	<0.031	<0.031	<0.031

Table 7-2
CALCULATION OF PROPOSED TREATMENT STANDARDS FOR METAL CONSTITUENTS IN K028 NONWASTEWATERS

<u>Regulated Constituent</u>	Arithmetic Average of Corrected Treatment Values ^a (ppm)	Factor	Variability (Average x VF) (VF)	Treatment Standard ^a (ppm)
159. Chromium (total)	0.021		3.5	0.073
161. Lead	0.010		2.0	0.021
163. Nickel	0.031		2.8	0.088

^aThe treatment standard values shown in this table have been rounded off to show two significant figures.

Table 7-3

CALCULATION OF PROPOSED TREATMENT STANDARDS FOR ORGANIC CONSTITUENTS IN K029 WASTEWATERS

Regulated BDAT List Constituent	K019 Constituent from which Treatment Data were Transferred	** Arithmetic Avg. of Corrected Treatment Values (ppm)	Variability Factor (VF)	** Treatment Std. (Avg x VF) (ppm)
Volatiles				
14. Chloroform	Chloroform			
23. 1,2 Dichloroethane	1,2 Dichloroethane	0.003	2.8	0.007
24. 1,1 Dichloroethylene	Hexachloroethane	0.003	2.8	0.007
45. 1,1,1 Trichloroethane	1,1,1 Trichloroethane	0.012	2.8	0.033
50. Vinyl Chloride	Hexachloroethane	0.003	2.8	0.007
		0.012	2.8	0.033

** The values shown on this table for arithmetic averages and treatment standards have been rounded to show significant figures only.

Table 7-4

CALCULATION OF PROPOSED TREATMENT STANDARDS FOR ORGANIC CONSTITUENTS IN K095 WASTEWATERS

Regulated BDAT List Constituent	K019 Constituent from which Treatment Data were Transferred	** Arithmetic Avg. of Corrected Treatment Values (ppm)	Variability Factor (VF)	** Treatment Std. (Avg x VF) (ppm)
Volatiles				
40. 1,1,1,2 Tetrachloroethane	1,1,1 Trichloroethane	0.003	2.8	0.007
41. 1,1,2,2 Tetrachloroethane	1,1,1 Trichloroethane	0.003	2.8	0.007
42. Tetrachloroethene	Tetrachloroethene	0.012	2.8	0.033
46. 1,1,2 Trichloroethene	1,1,1 Trichloroethane	0.003	2.8	0.007
47. Trichloroethene	Trichloroethene	0.012	2.8	0.033
Semivolatiles				
113. Hexachloroethane	Hexachloroethane	0.012	2.8	0.033
137. Pentachloroethane	1,1,1 Trichloroethane	0.003	2.8	0.007

** The values shown on this table for arithmetic averages and treatment standards have been rounded to show significant figures only.

Table 7-5

CALCULATION OF PROPOSED TREATMENT STANDARDS FOR ORGANIC CONSTITUENTS IN K096 WASTEWATERS

Regulated BDAT List Constituent	K019 Constituent from which Treatment Data were Transferred	** Arithmetic Avg. of Corrected Treatment Values (ppm)	Variability Factor (VF)	** Treatment Std. (Avg x VF) (ppm)
Volatiles				
40. 1,1,1,2 Tetrachloroethane	1,1,1 Trichloroethane	0.003	2.8	0.007
41. 1,1,2,2 Tetrachloroethane	1,1,1 Trichloroethane	0.003	2.8	0.007
42. Tetrachloroethene	Tetrachloroethene	0.012	2.8	0.033
46. 1,1,2 Trichloroethene	1,1,1 Trichloroethane	0.003	2.8	0.007
47. Trichloroethene	Trichloroethene	0.012	2.8	0.033
Semivolatiles				
113. Hexachloroethane	Hexachloroethane	0.012	2.8	0.033
137. Pentachloroethane	1,1,1 Trichloroethane	0.003	2.8	0.007

**The values on this table for arithmetic averages and treatment standards have been rounded to show significant figures only.

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APPENDIX A

WASTE CHARACTERISTICS AFFECTING PERFORMANCE

TABLE A-1

LIST OF BOND DISSOCIATION ENERGIES CALCULATED FOR CONSTITUENTS OF INTEREST

<u>Constituents</u>	<u>Bond Dissociation Energy (KCAL/MOL)</u>
7. Carbon Tetrachloride	320
9. Chlorobenzene	1330
14. Chloroform	340
22. 1,1-Dichloroethane	645
23. 1,2-Dichloroethane	645
24. 1,1-Dichloroethylene	505
40. 1,1,1,2-Tetrachloroethane	605
41. 1,1,2,2-Tetrachloroethane	605
42. Tetrachloroethene	465
45. 1,1,1-Trichloroethane	625
46. 1,1,2-Trichloroethane	625
47. Trichloroethene	485
50. Vinyl chloride	525
68. Bis (2-chloroethyl) ether	1290
86. 1,3-Dichlorobenzene	1325
88. p-Dichlorobenzene	1325
109. Fluorene	2725
110. Hexachlorobenzene	1305
113. Hexachloroethane	565
121. Naphthalene	2118
136. Pentachlorobenzene	1310
137. Pentachloroethane	585
141. Phenanthrene	2902
148. 1,2,4,5-Tetrachlorobenzene	1315
150. 1,2,4-Trichlorobenzene	1320

Sources: Sanderson, R.T. Chemical Bonds and Bond Energy, Reference 9.
Lange's Handbook of Chemistry, Reference 10.
Handbook of Chemistry and Physics, Reference 11.

APPENDIX B
QUALITY ASSURANCE/QUALITY CONTROL DATA

<u>Table</u>	
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Summary of Accuracy Correction Factors for Metal Constituents in Stabilized F024 Incinerator Ash	B-2
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Summary of Accuracy Correction Factors for Organic Constituents in K019 Scrubber Water	B-4

Table B-1

STABILIZED F024 INCINERATOR ASH MATRIX SPIKE RECOVERIES FOR METAL CONSTITUENTS

Cement Binder: Run #2

BDAT List Constituent	Original Amount Found ^a (ppm)		Amount Spiked (ppm)	Sample Result		Duplicate Sample Result		Relative Percent Difference (%)
				Amount Recovered (ppm)	Percent Recovery ^b (%)	Amount Recovered (ppm)	Percent Recovery ^b (%)	
155. Arsenic	0.0036		0.1	0.105	101.3	0.109	105	3.7
156. Barium	1.84		2	3.70	93.2	3.78	97.2	2.1
157. Beryllium	<0.0009		2	1.74	87.1	1.75	87.6	0.6
158. Cadmium	<0.0027		2	1.61	80.3	1.62	80.9	0.8
159. Chromium (total)	0.0311		2	1.77	87.2	1.79	88.0	0.9
221. Chromium (VI)	0.00944		0.010	0.0185	90.8	0.185	90.8	0.0
160. Copper	<0.0179		2	1.71	85.6	1.71	85.6	0.0
161. Lead	0.0112		0.075	0.007	78.4	0.0735	83.1	4.9
162. Mercury	0		0.0005	0.000483	96.6	0.000497	99.4	2.9
163. Nickel	<0.0249		2	1.61	80.5	1.59	79.7	1.0
168. Zinc	0.0406		2	1.61	78.3	1.66	81.2	3.5
* Aluminum	0.4542		2	2.25	90.0	2.28	91.4	1.2
* Calcium	2000		1000	3020	102	3060	106	1.3
* Cobalt	<0.0102		2	1.52	75.8	1.57	78.6	3.7
* Iron	0.0219		2	1.66	81.8	1.66	82.1	0.3
* Magnesium	0.0947		2	1.71	80.7	1.70	80.4	0.4
* Manganese	<0.0012		2	1.62	80.9	1.62	81.0	0.1
* Molybdenum	0.0623		2	1.78	85.7	1.75	84.5	1.3
* Sodium	37.4		24	62.2	103	63.7	110	2.3
* Tin	<0.105		4	4.01	100	4.05	101	0.8

*non-BDAT List Constituents

^aFor constituents not detected in the treatment residual at or above the detection limit (DL), the original amount found is considered as zero in calculating percent recovery.

^bPercent recovery = $100 \times (C_1 - C_0) / C_t$, where C_1 = amount recovered, C_0 = original amount found, and C_t = amount spiked.

TABLE B-2

SUMMARY OF ACCURACY CORRECTION FACTORS
FOR METAL CONSTITUENTS IN STABILIZED F024 INCINERATOR ASH

<u>BDAT List Constituent</u>	<u>Accuracy Correction Factor*</u>
155. Arsenic	1.000
156. Barium	1.073
157. Beryllium	1.148
158. Cadmium	1.245
159. Chromium (total)	1.147
221. Chromium (VI)	1.101
160. Copper	1.168
161. Lead	1.276
162. Mercury	1.035
163. Nickel	1.255
168. Zinc	1.277
* Aluminum	1.111
* Calcium	1.000
* Cobalt	1.319
* Iron	1.222
* Magnesium	1.244
* Manganese	1.236
* Molybdenum	1.183
* Sodium	1.000
* Tin	1.000

*non-BDAT List constituent

*The accuracy correction factor is equal to 1 divided by the percent recovery correction factor.

TABLE B-3

MATRIX SPIKE RECOVERIES FOR COMBUSTION GAS SCRUBBER DISCHARGE WATER

Spike Constituent	Sample Result				Duplicate Sample Result		
	Original Amount Found (ppb)	Amount Spiked (ppb)	Amount Recovered (ppb)	Percent* Recovery (%)	Amount Spiked (ppb)	Amount Recovered (ppb)	Percent* Recovery %
<u>Volatiles</u>							
4. Benzene	<2	25	21	84	25	17	68
7. Carbon Tetrachloride	**						
9. Chlorobenzene	<2	25	29	116	25	23	92
14. Chloroform	**						
21. Dichlorodifluoromethane	**						
22. 1,1-Dichloroethane	**						
23. 1,2-Dichloroethane	**						
24. 1,1-Dichloroethylene	<2	25	12	48	25	11	44
42. Tetrachloroethene	**						
43. Toluene	**						
45. 1,1,1-Trichloroethane	**						
47. Trichloroethene	<2	25	21	84	25	27	108
AVERAGE PERCENT RECOVERY FOR VOLATILE				83			78

*Percent recovery = $100 \times (C_1 - C_0) / C_t$, where C_1 = amount recovered, C_0 = original amount found, and C_t = amount spiked.

**No matrix spike was performed for this constituent. The percent recovery used for this constituent is based on the lower average percent recovery of the volatile constituents. The lower average percent recovery is 78% from the duplicate sample result.

+No matrix spike was performed for this constituent. The percent recovery used for this constituent is based on the lower average percent recovery of the semivolatiles (base/neutral) constituents. The lower average percent recovery is 85% from both sample results.

TABLE B-3 (Continued)

MATRIX SPIKE RECOVERIES FOR COMBUSTION GAS SCRUBBER DISCHARGE WATER

Spike Constituent	Sample Result				Duplicate Sample Result			
	Original Amount Found (ppb)	Amount Spiked (ppb)	Amount Recovered (ppb)	Percent* Recovery (%)	Amount Spiked (ppb)	Amount Recovered (ppb)	Percent* Recovery %	
Semivolatiles (Base/Neutral Fraction)								
52. Acenaphthene	<5	50	51	102	50	51	102	
68. Bis(2-chloroethyl)ether	+							
88. 1,4-Dichlorobenzene	<2	50	34	68	50	35	70	
98. Di-n-butylphthalate	+							
102. 2,4-Dinitrotoluene	<2	50	43	86	50	42	84	
105. N-Nitroso-di-n-propylamine	<5	50	50	100	50	46	92	
109. Fluorene	+							
110. Hexachlorobenzene	+							
113. Hexachloroethane	+							
121. Naphthalene	+							
136. Pentachlorobenzene	+							
141. Phenanthrene	+							
145. Pyrene	<2	50	43	86	50	43	86	
148. 1,2,4,5-Tetrachlorobenzene	+							
150. 1,2,4-Trichlorobenzene	<10	50	30	60	50	34	68	
AVERAGE PERCENT RECOVERY FOR SEMIVOLATILES (BASE/NEUTRALS)				84			84	

*Percent recovery = $100 \times (C_1 - C_0) / C_t$, where C_1 = amount recovered, C_0 = original amount found, and C_t = amount spiked.

**No matrix spike was performed for this constituent. The percent recovery used for this constituent is based on the lower average percent recovery of the volatile constituents. The lower average percent recovery is 78% from the duplicate sample result.

+No matrix spike was performed for this constituent. The percent recovery used for this constituent is based on the lower average percent recovery of the semivolatiles (base/neutral) constituents. The lower average percent recovery is 85% from both sample results.

Table B-4

SUMMARY OF ACCURACY CORRECTION FACTORS FOR
ORGANIC CONSTITUENTS IN K019 SCRUBBER WATER

<u>Constituent</u>	<u>Accuracy Correction Factor*</u>	
	<u>Scrubber Water</u>	<u>Total Composition</u>
7. Carbon tetrachloride		1.28
9. Chlorobenzene		1.09
14. Chloroform		1.28
21. Dichlorodifluoromethane		1.28
22. 1,1-Dichloroethane		1.28
23. 1,2-Dichloroethane		1.28
42. Tetrachloroethene		1.28
43. Toluene		1.28
45. 1,1,1-Trichloroethane		1.28
47. Trichloroethene		1.28
68. Bis(2-chloroethyl)ether		1.19
70. Bis(2-ethylhexyl)phthalate		1.19
88. p-Dichlorobenzene		--
98. Di-n-butylphthalate		1.47
109. Fluorene		1.19
110. Hexachlorobenzene		1.19
113. Hexachloroethane		1.19
121. Naphthalene		1.19
136. Pentachlorobenzene		1.19
141. Phenanthrene		1.19
148. 1,2,4,5-Tetrachlorobenzene		1.10
150. 1,2,4-Trichlorobenzene		1.67

*The Accuracy Correction Factor is equal to 1 divided by the Percent Recovery Correction Factor.